

Study Group 3

ELECTRONIC FUNDAMENTALS

Service Practices 5:

HOW TO ERECT
ANTENNAS

Service Practices 6:

HOW TO REPAIR
AND POLISH CABINETS



RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION OF AMERICA

New York,

N. Y.



ELECTRONIC FUNDAMENTALS

SERVICE PRACTICES 5

HOW TO ERECT ANTENNAS

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Service Practices 5

INTRODUCTION

An *antenna* is a device usually made of wires or other conductors for the purpose of transmitting or receiving signals. The purpose of this Service Practices booklet is to give you some practical information about *radio receiving antennas*, and when and how to install them. Television antennas are discussed later in this course.

As we said in Service Practices 4, most radio receivers today are made with antennas already built in. Most of these receivers give satisfactory service without any additional antenna. However, there are some places in this country where good radio reception is not possible without installing an additional antenna — even for some of the receivers that already have built-in antennas. So, when a case comes up in which an external antenna is needed, you will be expected to know how to install one.

5-1. THE PURPOSE OF A RECEIVING ANTENNA

The purpose of a receiving antenna is to pick up the signals sent out by broadcasting stations and carry them to the receiver. A radio broadcasting station sends out what we will call *radio waves*. (Later in this course, we will discuss them more accurately. At that time, you will learn why we call them radio waves now.) These radio waves, in passing a radio antenna, produce potential differences on the antenna; this causes antenna currents to flow.

Not only does the receiving antenna pick up the signals from the station you want to listen to, but it also picks up signals from other stations, near and far from your receiver. When your receiver is turned on, and you tune to a particular station, the tuned

circuits of your receiver select, from all of these radio signals, the signals of the station you want to hear. Antennas themselves may be tuned to a particular signal frequency. An example of this is any TV antenna that you have seen. Yet, even in the case of a tuned antenna, other signals are present in some amount, and it is necessary for the tuned circuits of the receiver to reject the unwanted signals and accept the signals of the wanted station.

The amount of signal voltage that the antenna picks up is determined by four main factors:

1. The amount of power transmitted by the broadcasting station; the greater the power, the stronger is the signal.
2. The distance the receiving antenna is from the transmitting antenna; the nearer they are to each other, the greater is the signal.
3. The efficiency of the antenna; the more effective the antenna is in picking up wanted radio signals, the greater is the signal voltage.

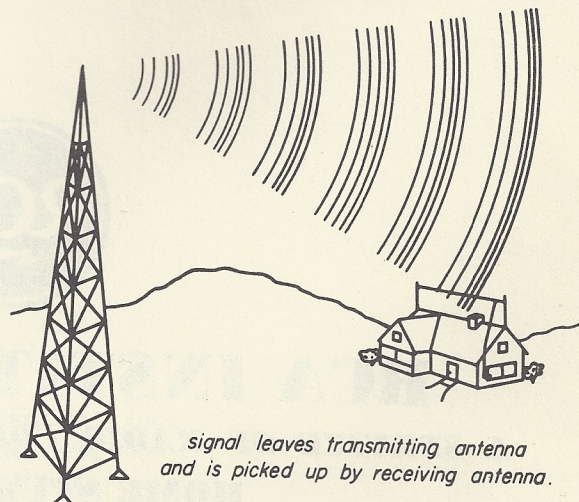


Fig. 5-1

age across the antenna, and, it follows, the greater the antenna currents will be.

4. What signal-absorbing mass is between the transmitting antenna and the receiving antenna.

The last factor sometimes makes an external antenna necessary. While antenna theory is the subject of a later Theory Lesson, you should know now why something between the broadcasting station and the receiver should affect signal strength. So, let us compare the transmitting antenna of a broadcasting station with a lighthouse. In Fig. 5-2, we see a lighthouse radiating its light beams to all points of the compass. On a clear night, its light can be seen for miles around. Very close to the lighthouse, the light is very bright; but the farther we get from it, the less bright is its light, until there is only a dim pinpoint of light many miles away.

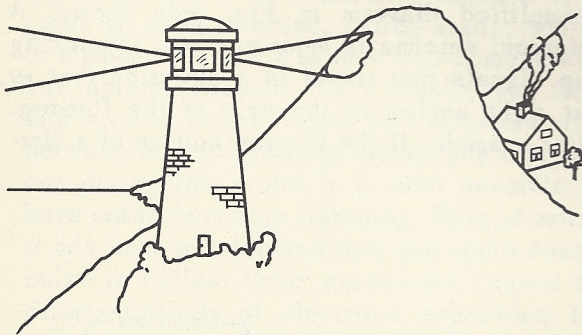


Fig. 5-2

However, on the land side of the lighthouse, there is a steep hill. People who live down on the other side of the hill cannot see the light at all, even though they live only a mile away from the lighthouse. To be sure, on certain nights when the clouds hang just right, they can see a reflected glow, which tells them that the light is lit — but that is all.

In much the same way, broadcasting transmitting antennas radiate their signals. The nearer we are to a transmitting antenna, the stronger is the signal. Very close to a broadcasting station, you can measure the signal in volts, while if your receiver is some distance from the transmitter, the signal may be measured in microvolts. A receiver very close to the transmitting antenna sometimes has to be protected by certain devices to prevent the high signal voltage from damaging the receiver. A receiver some distance from the transmitter may need to amplify the signal more, in order that it may be heard. Yet, people who live reasonably close by, but with hills or mountains between them and the transmitter, find that the signal is very weak, except on certain days when they get a reflected wave from the sky. People who live in valleys often have difficulty getting satisfactory reception on nearby radio stations that are outside of the valley.

Town and city people who live near tall, steel-framework buildings have the same trouble receiving signals when the buildings are between them and the wanted station. As shown in Fig. 5-3, the people who live in house A have difficulty in receiving signals from Station Y, although they get excellent

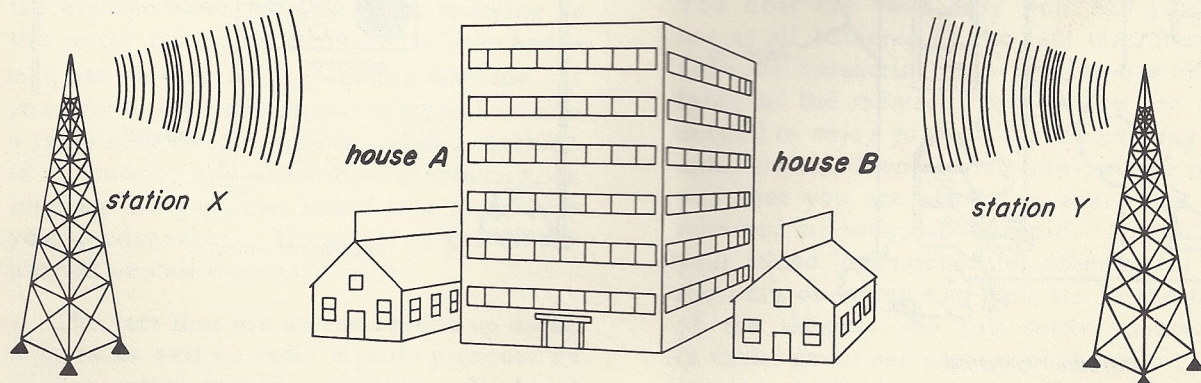


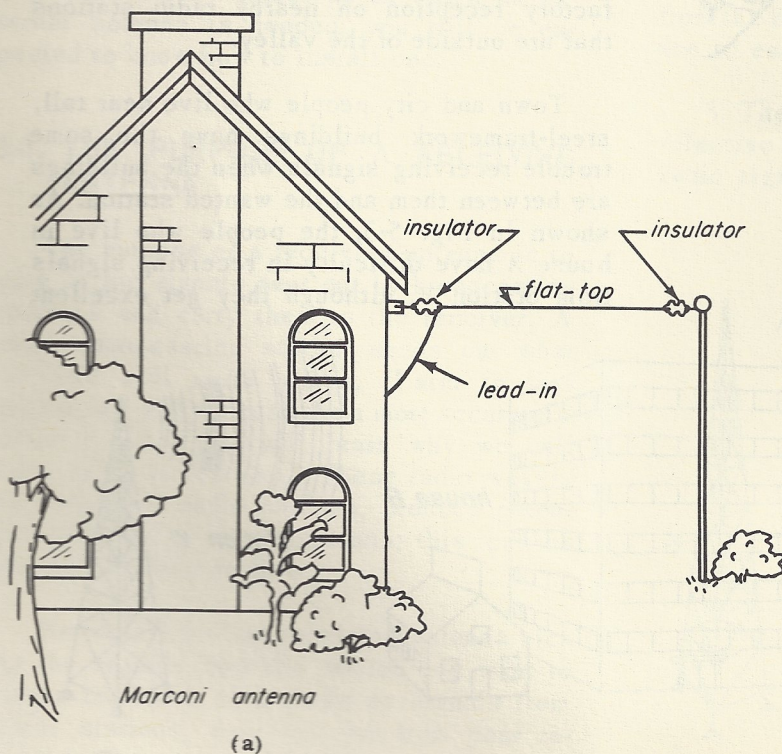
Fig. 5-3

reception from Station X. On the other hand, people who live in house B get excellent reception from Station Y and have quite a lot of trouble receiving Station X.

Hills and mountains, particularly those with large amounts of iron and other minerals, absorb radio signals. That is why people who live where hills and mountains interfere with reception are good prospects for external antennas. And the people who live in large towns and cities, with homes located near tall steel-framework buildings that absorb and block radio signals, are equally good prospects. In this booklet, you will learn how a simple external antenna may help to improve radio reception in these cases.

5-2. TYPES OF ANTENNAS

For our purposes, we can divide receiving antennas into three main classes: built-in antennas (part of the receiver), indoor antennas (not part of the receiver), and outdoor antennas. This booklet is not concerned with built-in antennas. However, you will find them discussed completely in a Theory Lesson on antennas later in this course.



Practically anything that is capable of conducting electricity may be connected to a receiver and act as an antenna. In fact, one of the tests that servicemen use in testing an old-fashioned radio, designed for an outside antenna, is to place a finger on the antenna post with the set turned on and the volume turned up to see if the set plays. In such a case, the serviceman uses himself as an antenna to intercept radio signals and to bring them to the receiver. A short length of wire connected in the same manner will work in much the same way. The commonest form of outdoor antenna used for radio receivers is called the *Marconi antenna*, which looks like an inverted L. Figure 5-4a shows a Marconi antenna. If you look at the drawing, you will see that the greater length of such an antenna is called the *flat-top* (the long side of the L), while the shorter length, leading from the flat-top to the receiver, is called the *lead-in*. The length of the antenna is the sum of the length of the flat-top and the length of the lead-in. A ground return is an important part of the Marconi antenna, as the simplified diagram in Fig. 5-4b shows. A Marconi antenna is most efficient in picking up signals that travel in a direction that is at right angles to the axis of the flat-top. For example, if the flat-top portion of a Mar-

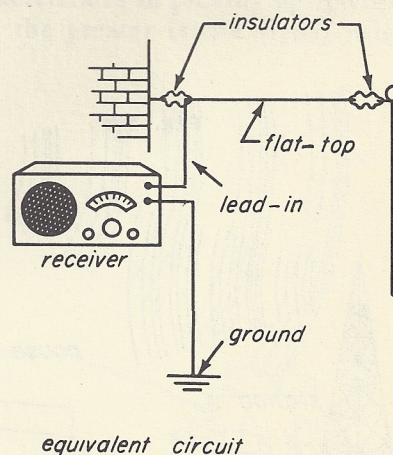


Fig. 5-4

coni antenna is run in a line from north to south, it will be best able to receive signals coming from the east or the west. It will receive signals coming directly from the north or from the south with decreased efficiency. This is a point to remember. We will speak of it again shortly.

There are other outdoor antennas that we will discuss later in this Services Practices booklet when we discuss special purpose antennas.

5-3. STATIC

We mentioned before that the antenna picks up signals from unwanted stations as well as the wanted frequencies. This is no great disadvantage, because, with a good tuning system, we can select the station that we wish to hear. In fact, if the antenna did not pick up other stations, we would have to have a different antenna, or a different receiver, for each station that we wished to listen to. However, a receiver antenna also picks up a lot of noise, called *static*, which is almost impossible to tune out. Some static has natural causes. For example, you find that a radio is very noisy in a thunderstorm, because of the lightning discharges that occur during the storm. It is also possible to have noise from heat lightning. What is more, it has been established that sun spots cause noise in radios. Other noises are caused by different kinds of electrical apparatus; for example, dial telephones, electric shavers, buzzers and bells, automobile ignition systems, elevators, X-ray machines — in fact, any type of electrical device that is capable of producing a spark. You may have noticed the brushes of an electric motor sparking as the motor turned. You may have watched a man use an electric-arc welding machine. If you ever had the misfortune to try to listen to a radio near an electric-arc welding machine in operation, you know that electricity, in jumping the gap, can sound like thunder in your loudspeaker. These electrical disturbances we call *man-made static*.

The fact that the antenna picks up noise signals as well as radio signals presents us with a very interesting problem. We know that we can tune out unwanted radio signals,

and we also know that it's practically impossible to tune out noise. Yet we would like our radios to be as free from noise as as they are from unwanted radio signals. Fortunately there are ways to get rid of some noises. Some of these ways will be discussed in this and other Service Practices booklets.

5-4. SIGNAL-TO-NOISE RATIO

When a radio signal is very great and the noise signal is small, we hear only the radio signal and we don't hear the noise signal at all. When both signals are of the same strength, we hear both the radio signal and the noise signal at the same time. When the noise signal is great and the radio signal is small, we hear only the noise signal and we don't hear the radio signal at all. Servicemen compare the efficiency of antennas by comparing the pickup of radio signals with the pickup of noise signals. They speak of the *signal-to-noise ratio*. This means that they find out how many times greater the desired radio-signal voltage is than the noise-signal voltage. When the desired radio-signal voltage is many times the voltage of the noise signal, there is a high signal-to-noise ratio, and reception is practically noise-free. However, when the signal level is low and the noise level is high, then the signal-to-noise level is very low, and reception is very noisy.

Let's see why this should be so. We'll compare it with something almost everyone has experienced. Let's suppose that you and a friend are at a movie or at a show of some sort and you are sitting down front. You hear the show very well and you are not at all bothered by the fact that there is someone hammering on a display out in the lobby of the theatre. Just as you are well settled to enjoy yourself for the evening, an usher comes down to your row and he tells you that you are sitting in seats that are reserved for some other people. So you and your friend look around for other seats and the only ones you can find are in the back of the theatre. So you settle yourselves in these seats and prepare once again to enjoy the show. However, the hammering that you did not hear down front, because of the

volume of sound from the stage, is much clearer to you and louder, while the volume of sound from the stage is much lower because you are farther from it. As a result, you find that you no longer enjoy the show as much as you did because of the hammering.

Let the sounds from the stage that you want to hear represent the *signal* and the sound of the hammering represent the *noise*. We can compare this situation with the signal-to-noise ratio. When you sat down front, the signal was very loud because you were close to it, and the noise was very low because you were far from it. So you can see that, in the first position, the signal-to-noise ratio was high. As a result, you enjoyed the show because it was practically noise-free. But, in the second position, in the back of the theatre, the signal (the sound from the stage) was very much lower because you were far from it, while the noise (of the hammering) was very much higher because you were close to it. So, in this second position, you can see that the signal-to-noise ratio was very low, and as a result, you did not enjoy the show because of the noise.

5-5. REDUCING NOISE

There are two major ways of reducing noise. The first, is to try to reduce or eliminate the noise at the source by working on the machinery that makes the noise and seeing what can be done to prevent it from radiating noise. Reduction of noise at the source of the noise is the subject of a later Service Practices booklet. The second way to reduce noise is to try to reduce it at the receiver. Perhaps, from the discussion of the show and the hammering, you may have an idea of the method used to reduce noise at the receiver end.

In the theatre, we found we had to be far from the noise and close to the signal in order to enjoy the show. Naturally, we can't all live near a radio station. Frankly, you wouldn't want to, because you might have difficulty in listening to any other station. Sometimes, it is possible for us to find a place where the signal-to-noise ratio is high

for most of the stations that we want to hear, and place our radio there. For most of us, there is no problem. However, there are many cases in which it is difficult to find a place in the house or apartment where the signal-to-noise ratio provides good reception on most stations. In areas where there are a good many noise problems, servicemen sometimes use a battery-operated portable radio and carry it around the house or apartment, looking for a spot with a good signal-to-noise ratio. If they don't find a spot in the house, they walk around outside the house looking for the spot where reception is best. They may find, for instance, that reception is excellent on the roof, or out in the backyard near the apple tree, or in the middle of the street outside, but these are unlikely places for installing a radio. So, the next best thing to do is to bring the conditions that exist in these places to the radio. This can be done by means of an outside antenna. Just erect an antenna in a spot where there is high signal-to-noise ratio and bring this good signal to the radio. This Service Practices booklet tells you about the installation of high-signal-to-noise ratio antennas.

5-6. ANTENNA EFFICIENCY

We measure the efficiency of antennas by their ability to pick up wanted radio signals and little noise — in other words, by their signal-to-noise ratio. A good antenna, therefore, is one with a high signal-to-noise ratio, and a poor antenna is one with a low signal-to-noise ratio. There are several factors that affect antenna efficiency. (In discussing the factors that affect antenna efficiency, we have in mind the simple, basic inverted-L type [Marconi] antenna. However, what we say about this antenna is true of most antennas.) The first factor that affects antenna efficiency is the length of the antenna. The longer the antenna, the more signal voltage it picks up and the stronger is the signal that reaches the radio receiver. There are practical limits to this, however; if we make an antenna too long, we tend to cause the radio receiver to be less selective and, as a result, stations tend to interfere with each other more than they would with a normal-length antenna. Remember that the

length of the antenna is the length of the flat-top added to the length of the lead-in. It is desirable to have the flat-top longer than the lead-in because the lead-in tends to pick up noise more than the flat-top does. The average antenna has a 50-foot flat-top and a 25-foot lead-in. These figures, of course, may be varied somewhat without making much difference to reception.

Another factor that affects antenna efficiency is the height of the antenna — the higher the antenna, the better the reception. There are several reasons for this. One of the most important of them is that the higher the antenna, the farther it is, as a rule, from the source of noise, particularly if that noise comes from equipment inside the house. However, there are practical limits to the height of the antenna. Most high antennas require the use of antenna masts. So, the higher the antenna, the longer the mast, and the more difficult and expensive is the installation, particularly if the mast is to withstand storms and high winds.

We have already indicated the third factor. It is the placement of the antenna. The efficient antenna is one that is placed where there is a high signal-to-noise ratio. Sometimes, this is much easier said than done. However, let us assume that a source of noise exists in a building next to the one where we are installing an antenna, as shown in Fig. 5-5a. If we place the antenna as shown in the figure, with the lead-in running as it is pictured, we will have a low signal-to-noise ratio. This is because the antenna, which includes the lead-in, is placed closer to the source of the noise. Now look at Fig. 5-5b. We have placed the antenna away from the source of noise, with the result that we have a higher signal-to-noise ratio than we had before. Notice in the second panel that the lead-in, which picks up noise and signal, is brought down so that it is as far away from the source of noise as is possible.

The efficiency of the antenna is not only affected by its placement with respect to the source of noise, but also with respect to metal and other grounded or ungrounded surfaces. For example, an antenna that runs near a metal-top roof, a metal gutter, a rain-pipe, or the metal girders of a steel-frame-

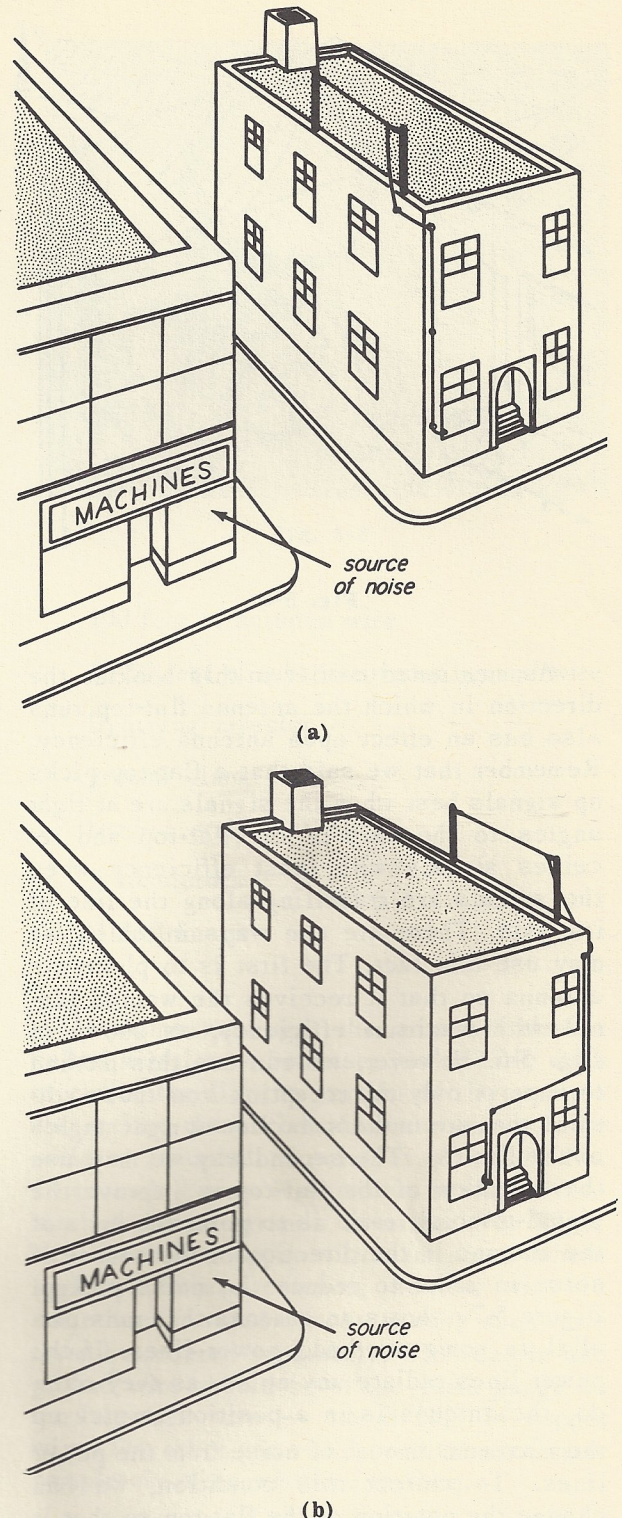


Fig. 5-5

work building loses a lot of its efficiency in two ways: one, because the metal surfaces absorb the radio signals, and two, because metal surfaces tend to radiate to the antenna any electrical noises that originate inside the building.

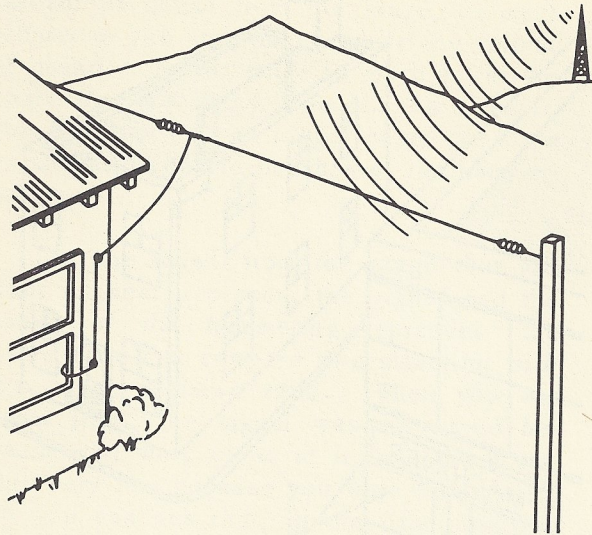
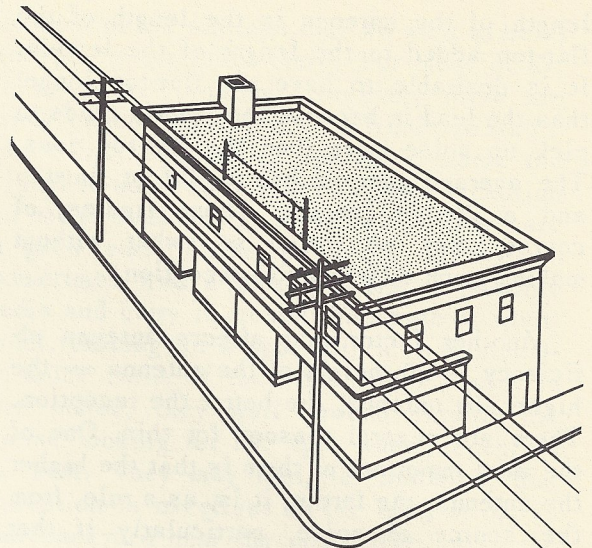


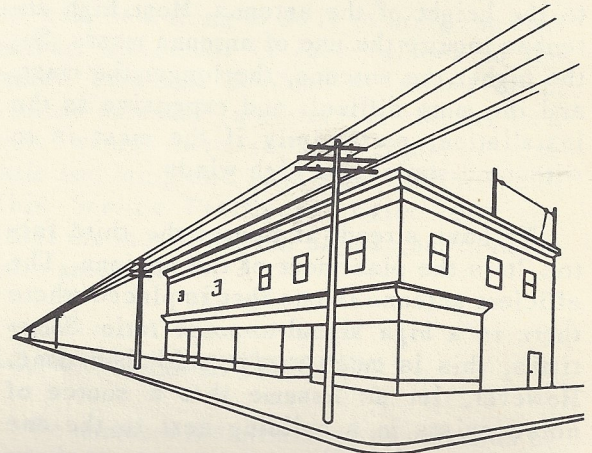
Fig. 5-6

As mentioned earlier in this booklet, the direction in which the antenna flat-top runs also has an effect upon antenna efficiency. Remember that we said that a flat-top picks up signals best when the signals are at right angles to the axis of the flat-top and receives signals with least efficiency when the signals are travelling along the line of its axis. There are two ways in which we may use this fact. The first is to place the antenna so that it receives the wanted signal with maximum efficiency, as shown in Fig. 5-6. However, we can use this method to improve only the reception from those stations that are in the same line at right angles to the flat-top. The second way we may use the direction of the flat-top to improve the signal-to-noise ratio is to point the ends of the antenna in the direction of the source of noise in order to reduce the noise pickup. Figure 5-7a shows an antenna that runs parallel to some overhead power lines. If the power lines radiate any noise, as they often do, the antenna is in a position to pick up the maximum amount of noise from the power lines. To correct this condition, we can change the position of the flat-top so that it points toward the power lines and is at right angles to them. In this position, the antenna picks up the minimum of noise from the power lines, with an improvement in signal-to-noise ratio.

Another very important fact that affects antenna efficiency is the use of a good



(a)



(b)

Fig. 5-7

ground return. This requires a firm connection to a grounded surface, such as a cold-water pipe or a steam-radiator pipe or to a pipe or metal rod driven into moist earth. *Never connect a ground lead to a gas pipe.* The lead from the ground connection to the radio receiver should be short as possible, because ground leads pick up noise just as easily as do antenna leads.

Warning: Do not connect a ground lead to an a.c.-d.c. receiver, unless the manufacturer has provided a binding post or grounding lead, plainly marked, for a ground connection. Should you ignore this warning, you will not only "blow" the power-line fuse, but you may also damage the receiver.

There are two other factors that are

likely to affect antenna efficiency. One of these is antenna resistance and the other is antenna leakage. Resistance may be introduced into the antenna by poor connections in the antenna system. For example, if the wires of the antenna flat-top and the lead-in are twisted together to make connection, within a very short time oxides and other impurities will tend to produce a poor electrical connection. When this happens, the signal currents picked up by the flat-top have more difficulty passing to the lead-in wire, and a portion of the signal current is lost. Another place where signal losses may occur due to resistance is at the lead-in strip (where the antenna is sometimes brought into the house), and at the ground connection.

Loss of signal due to leakage may be caused by using poor insulators. The best insulators are made of Pyrex glass or highly glazed porcelain. Other insulators may act as high-resistance conductors and, particularly in wet weather, permit the signal currents to travel directly to ground without going through the radio receiver.

5-7. PREPARATION FOR ERECTING OUT-DOOR ANTENNAS

Before erecting an outdoor antenna, it is necessary for you to decide where to place it, what will support the flat-top, how to bring the lead-in to the receiver, and where to run the ground lead. Use the facts given in the discussion of antenna efficiency to help you to make your choice. Once you know where the antenna is going, you can decide on the equipment you need to install one. There is no way in which this lesson can tell you just what to buy, because no two antennas are exactly alike. For most simple outdoor antenna installations, a kit of parts may be purchased from a radio parts distributor. Find out the name of one or two distributors in your area. You can probably do this by referring to the yellow pages (business listings) of your telephone directory.

A typical antenna kit, as shown in Fig. 5-8 consists of:

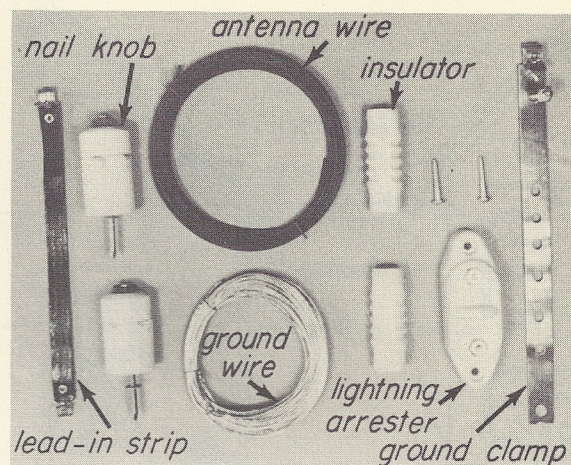
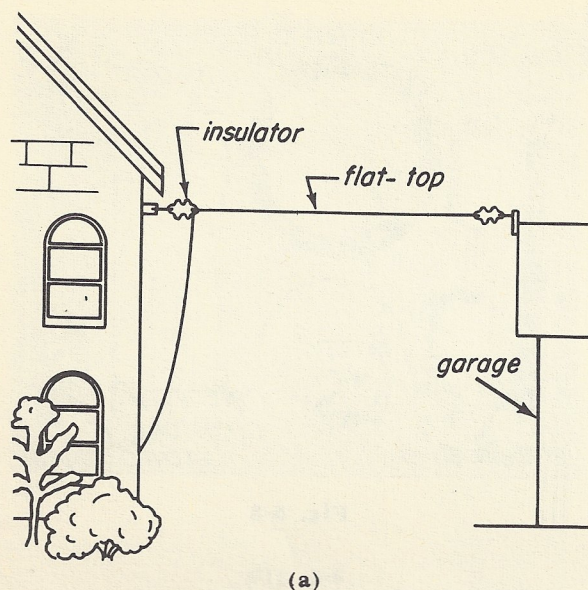


Fig. 5-8

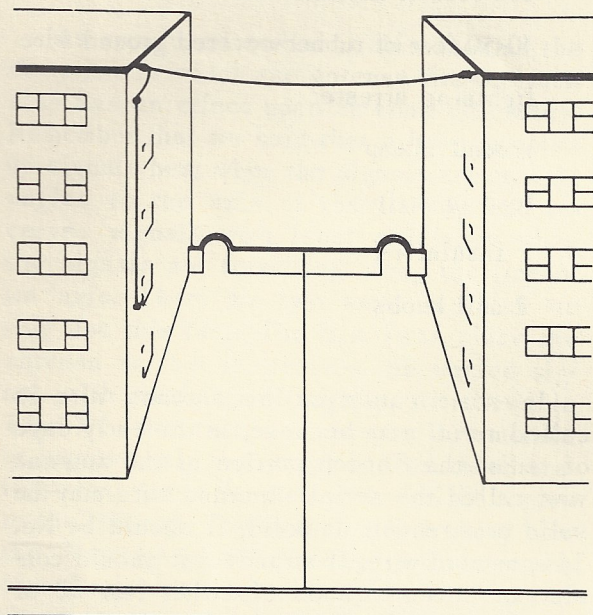
- 100 feet of antenna wire
- 40-50 feet of rubber-covered ground wire
- lightning arrester
- ground clamp
- lead-in strip
- 2 insulators
- 2 nail knobs

In some catalogs, the antenna wire is called *aerial wire* because, in the early days of radio, the flat-top portion of the antenna was called the aerial. Antenna wire may be solid or stranded. If solid, it should be No. 14 enameled wire. If stranded, it should consist of seven strands of either No. 22 or No. 24 bare copper wire. In areas where high winds are common, heavier wire is sometimes used. In most cases, such wire must be ordered separately. The lead-in and ground wire should be of the same gauge as the antenna wire — about No. 14 copper wire. The other parts will be discussed more completely when we come to them.

An antenna kit, together with a small pulley, a length of light rope, and some long tacks (equipment similar to that used by telephone company installation men when they run telephone wire inside a building for a telephone installation) is sufficient for simple antenna installations like the ones shown in Fig. 5-9a and b.



(a)



(b)

Fig. 5-9

5-8. ERECTING A SIMPLE INVERTED-L ANTENNA

A simple inverted-L antenna, as shown Fig. 5-9b, may be erected in the following steps:

Step 1. Fasten one end of the antenna wire to one of the insulators, as shown in Fig. 5-10.

Step 2. Feed a length of light rope through the hole in the other end of the insulator and tie it securely to the chimney.

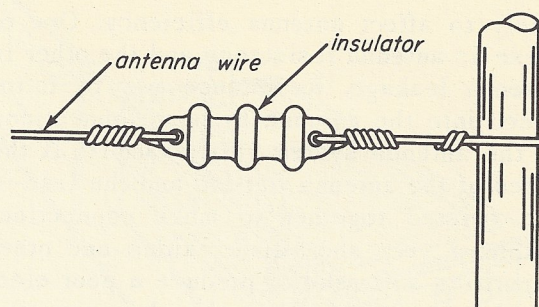


Fig. 5-10

Step 3. Measure how far from the chimney end the lead-in wire will be attached so that it does not scrape against the side of the roof on its way down to the receiver.

Step 4. Solder the lead-in to the flat-top at this point. Before soldering, make sure that you have made a very tight mechanical joint between the lead-in and the flat-top wire. If the flat-top wire is enameled, scrape the enamel away with the back of your pen-knife blade or with fine sandpaper before making the joint. Then solder the joint.

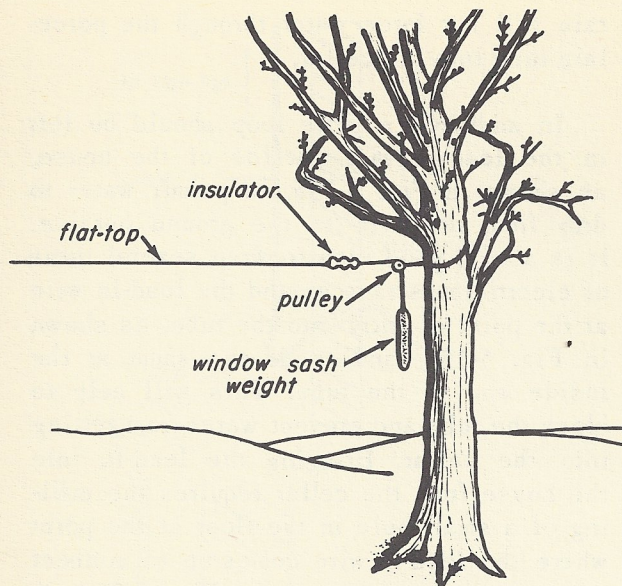
Step 5. Measure off, on the antenna wire, the amount that you plan to use for your flat-top. Then allow about 6 to 8 inches more wire for fastening the wire to the other insulator.

Step 6. Fasten the free end of the flat-top to the other insulator.

Step 7. Thread a length of rope through the other end of the insulator and tie it securely.

Step 8. Fasten the pulley to the roof of a barn, garage, or some other building that is convenient for this purpose.

Step 9. Thread the free end of the rope through the pulley wheel and pull the flat-top taut. Then tie the free end of the rope to the barn or garage. If the far end of the flat-top is attached to a tree instead of to a barn or garage, tie the pulley to the tree with sufficient length of rope so that the antenna is completely free from the branches and leaves of the tree, as shown in Fig. 5-11. In this case, instead of tying the free end



typical installation of an outdoor antenna with one support flexible

Fig. 5-11

of the flat-top rope to the tree, use a counterweight, like an old-type flatiron or a window sash weight, at the end so that the antenna will not snap when the tree sways in the wind. In such an installation, use the type of pulley that does not permit the rope to jam.

Step 10. With a porcelain nail knob, fasten the lead-in to the side of the house near the roof, as shown in Fig. 5-12. Leave a little slack between the nail knob and the flat-top so that the connection will not be broken during a storm.

Step 11. Fasten the lead-in to the casement of the window that is to be used for bringing the antenna into the house, as shown in Fig. 5-13. Make sure that the lead-in is taut between the two porcelain insulators so that it does not sway with the wind. Otherwise, the lead-in will sway back and forth from the building, and, particularly in wet weather, may cause fading in the receiver.

Step 12. Measure off, on the free end of the lead-in, the distance between the porcelain insulator and the lightning arrester.

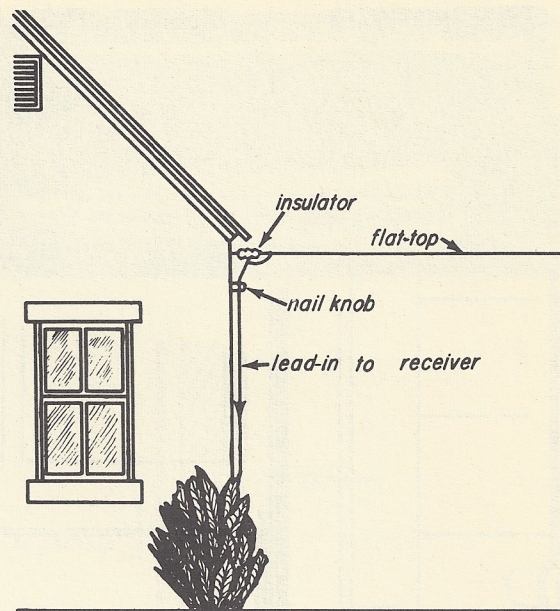


Fig. 5-12

Without cutting the lead-in wire, strip off about one-inch of insulation, as shown in Fig. 5-14a. Make sure that the exposed wire is clean and wrap it at once around

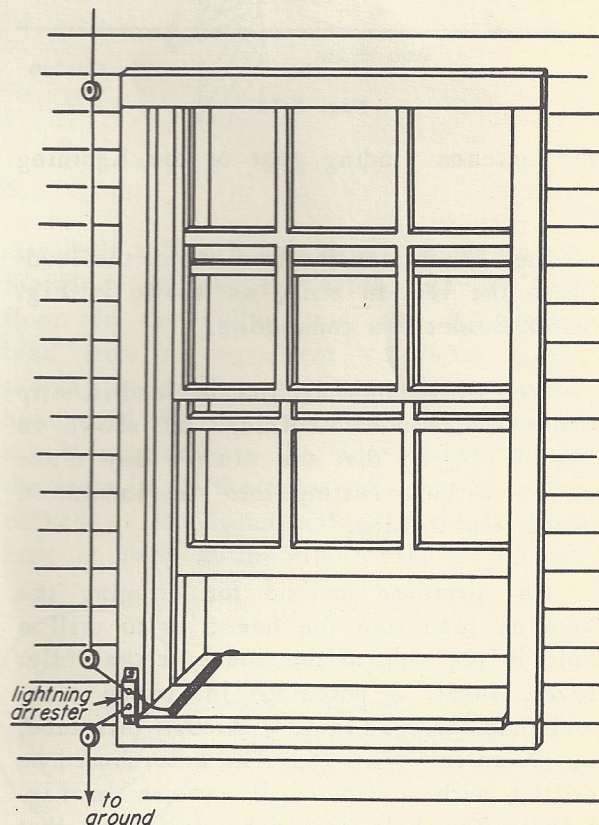


Fig. 5-13

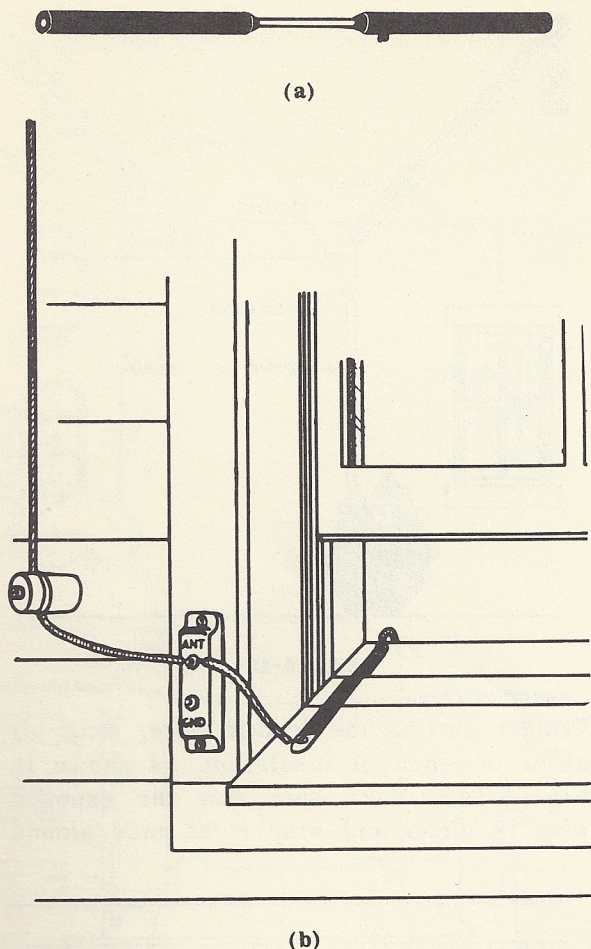


Fig. 5-14

the antenna binding post of the lightning arrester.

Step 13. Fasten the free end of the lead-in to the lead-in strip, as shown in Fig. 5-14b. Solder this connection.

Step 14. If possible, run the lead-in strip under the window molding, as shown in Fig. 5-14b, so that the window may close easily without cutting into the insulation of the lead-in wire.

An alternate method for bringing the antenna lead into the house is to drill a hole in the side of the house at the cellar level, insert a porcelain insulating tube, and feed the lead-in wire through this tube, as shown in Fig. 5-15a. The hole should be drilled with a star drill (shown in Fig. 5-15b). The hole should be drilled so that its direction is slightly upward from the outside toward the inside so that a heavy

rain will not force water through the porcelain tube into the cellar.

In addition, a little loop should be left in the lead-in wire outside of the house, as shown in Fig. 5-15a, to permit water to drip from the wire to the ground outside. It is also a good idea to wrap several turns of electrician's tape around the lead-in wire at the point of entry into the tube, as shown in Fig. 5-15c, and to do the same at the inside end of the tube. This will help to block the tube and prevent water from getting into the cellar. Bringing the lead-in into the house from the cellar requires the drilling of a small hole in the floor at the point where the lead-in wire comes up to connect to the radio, as shown in Fig. 5-15d. A $\frac{1}{4}$ -inch hole is usually sufficient.

Step 15. If you have brought the antenna lead-in through a window that is close to the receiver, a short length of lead-in wire should be sufficient to connect the inside terminal of the lead-in strip with the binding post or antenna lead from the radio. The connection at the lead-in strip should be soldered. If the receiver is some distance from the lead-in strip, it may be necessary to run a wire from the lead-in strip to the receiver. Ordinary lead-in wire is unsuitable; servicemen frequently use stranded single-conductor fixture wire. This wire may be obtained in several colors from stores that sell electrical lighting fixtures. If possible, select a color that matches the woodwork. Tack the wire to the molding with long tacks, similar to those that upholsterers and telephone installers use. Don't let your wiring sag and don't let the tacks cut into the wiring. A good example of such wiring is the wiring done by telephone installers. If you follow their example you can't go wrong.

Step 16. Select the nearest good grounded surface, such as a cold-water pipe, a steam-radiator, or a ground rod driven into moist earth. If the installation is in a private house, and there is a cold-water tap outside the house, run a ground to the pipe to which the cold-water tap is attached. Otherwise,

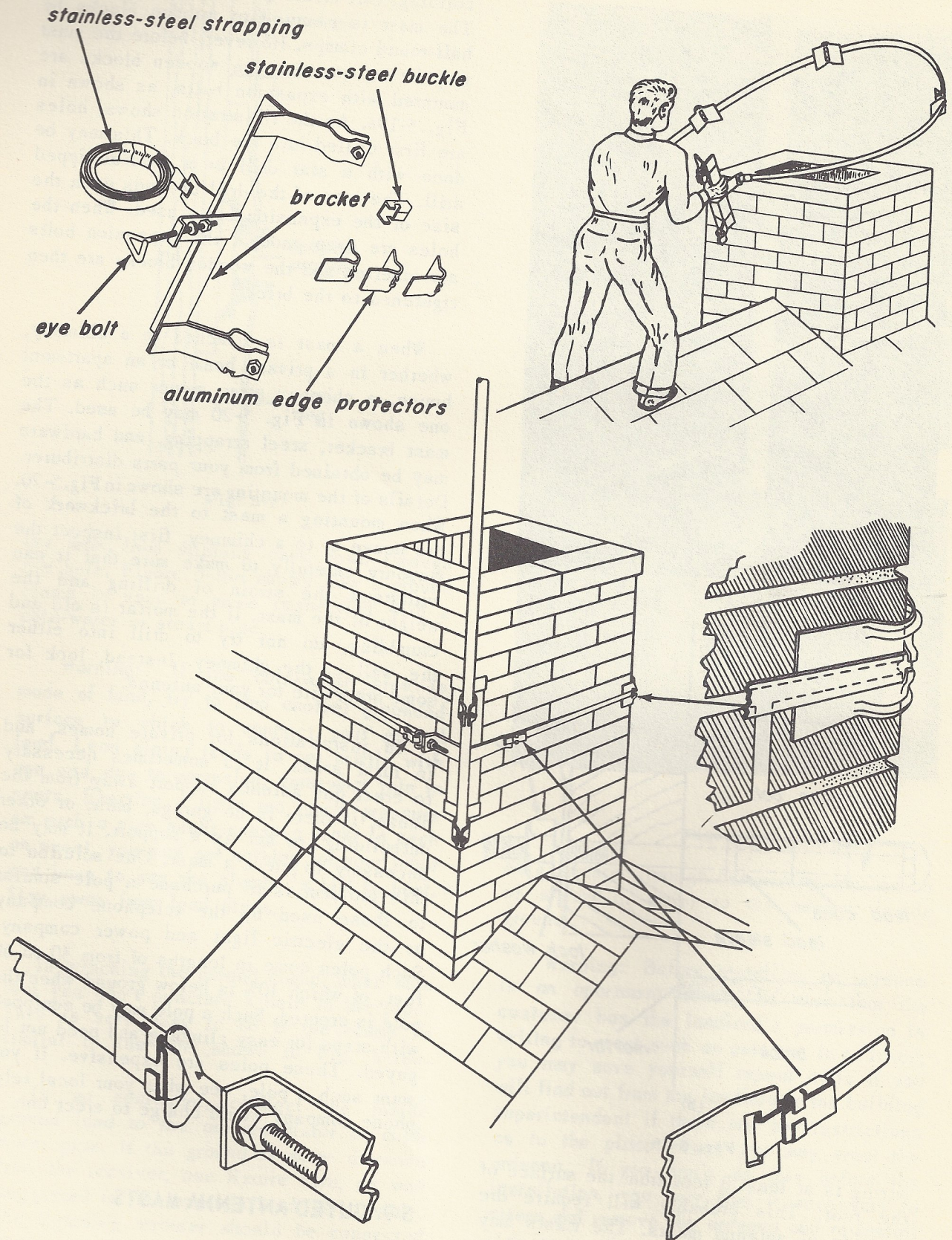


Fig. 5-20

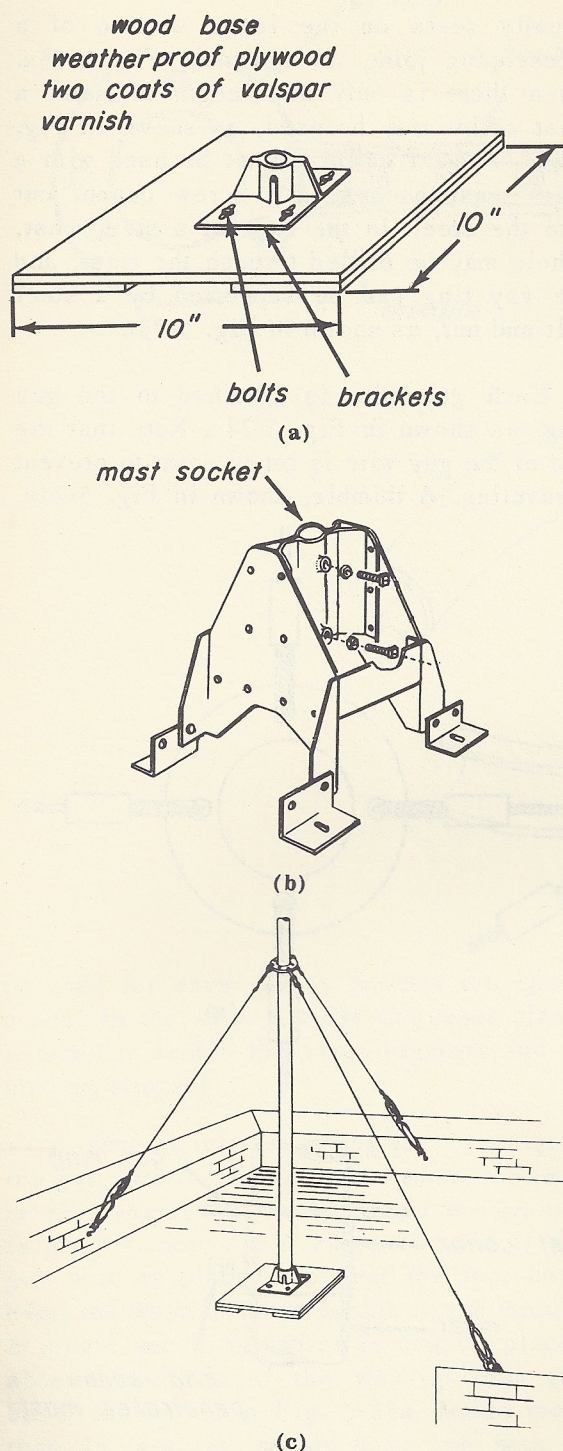


Fig. 5-21

mast. When a mast rises ten or more feet above its base support, guy wires should be used to prevent it from swaying in the wind. The mast may be made from steel or duraluminum pipe. A single section mast is usually made from 1-3/8-inch pipe. If additional sections are used, they may be of 1-5/8-, 1-7/8-, and 2-1/8-inch sections. Your

radio parts distributor can supply you with 8- to 12-foot mast sections that fit into each other like the sections of a telescope and with all of the hardware and wire necessary for erecting an antenna mast. It is impossible to give you complete instructions for the erection of all types of antenna mast; there are many different types that may be mounted in many different ways. However, the following paragraphs will supply you with some helpful information, should you have need to erect a tall mast.

On flat or peaked roofs, masts require a base support so that the mast does not dig a hole in the protective covering of the roof. Figure 5-21a shows a base support of the kind used on flat roofs. This type is also used to support the base of a mast that is erected on the ground. Figure 5-21b shows one type of bracket used for supporting masts on a peaked roof. In most cases, a mast mounted on the peak of the roof should be limited to no more than one 12-foot section. Do not use any base supports that require nails or screws to be driven into the protecting cover of the roof. Base supports are usually held in place by friction and the guy wires. Figure 5-21c shows one way of using the flat base support.

The wire used for guying must be able to withstand the pressure of high winds and the weight of ice forming on the antenna itself. The RCA Service Company uses a 42-strand galvanized wire made up of seven woven ropes of six strands each, capable of withstanding 600 pounds pressure. Your distributor may have a wire with fewer but heavier strands that will serve your needs. At least three guy wires should be used to support a mast so that the mast is supported no matter in what direction the wind blows. The greater support from the guys should be such as to oppose the wind, as shown in Fig. 5-22.

Guys should be equally spaced about a mast. For that reason, guy rings have six holes, as shown in Fig. 5-23a. Three or four equally spaced guy wires may be attached to these holes, as shown in Fig. 5-23 b and c. The guy ring slips freely on the mast and

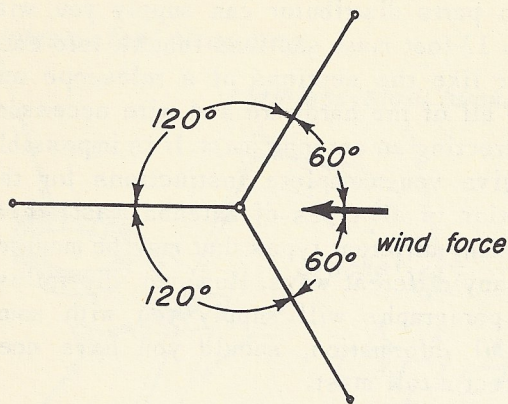


Fig. 5-22

usually rests on the lower section of a telescoping joint, as shown in Fig. 5-23d. When there is only one length of mast, a mast collar may be used, as shown in Fig. 5-23e. A mast collar cannot be used with a steel mast because the screw cannot cut into the steel. In the case of a steel mast, a hole may be drilled through the mast, and the guy ring can be supported by a steel bolt and nut, as shown in Fig. 5-23f.

Each guy wire is attached to the guy ring, as shown in Fig. 5-24a. Note that the end of the guy wire is taped down to prevent unraveling. A thimble, shown in Fig. 5-24b,

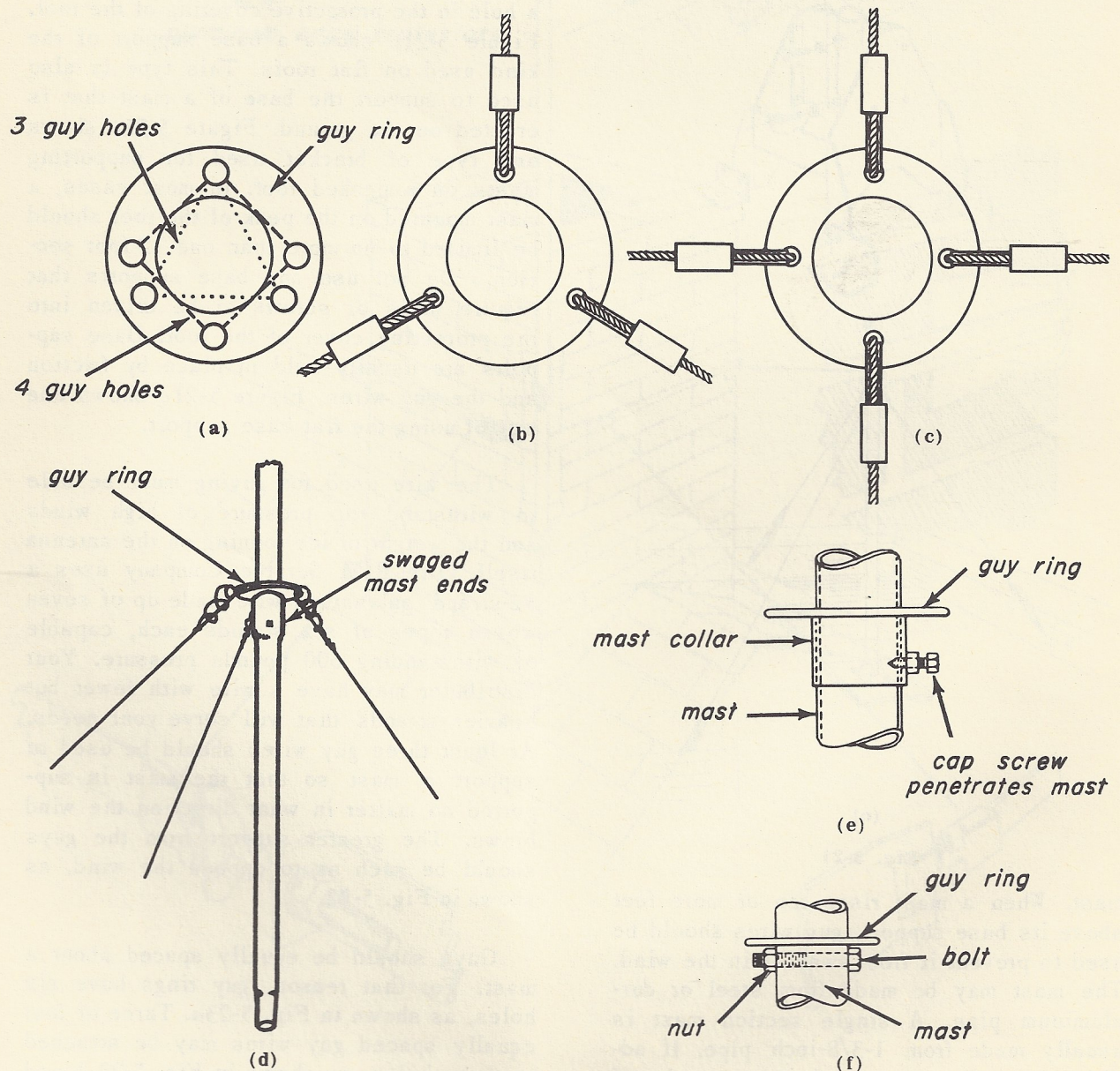


Fig. 5-23

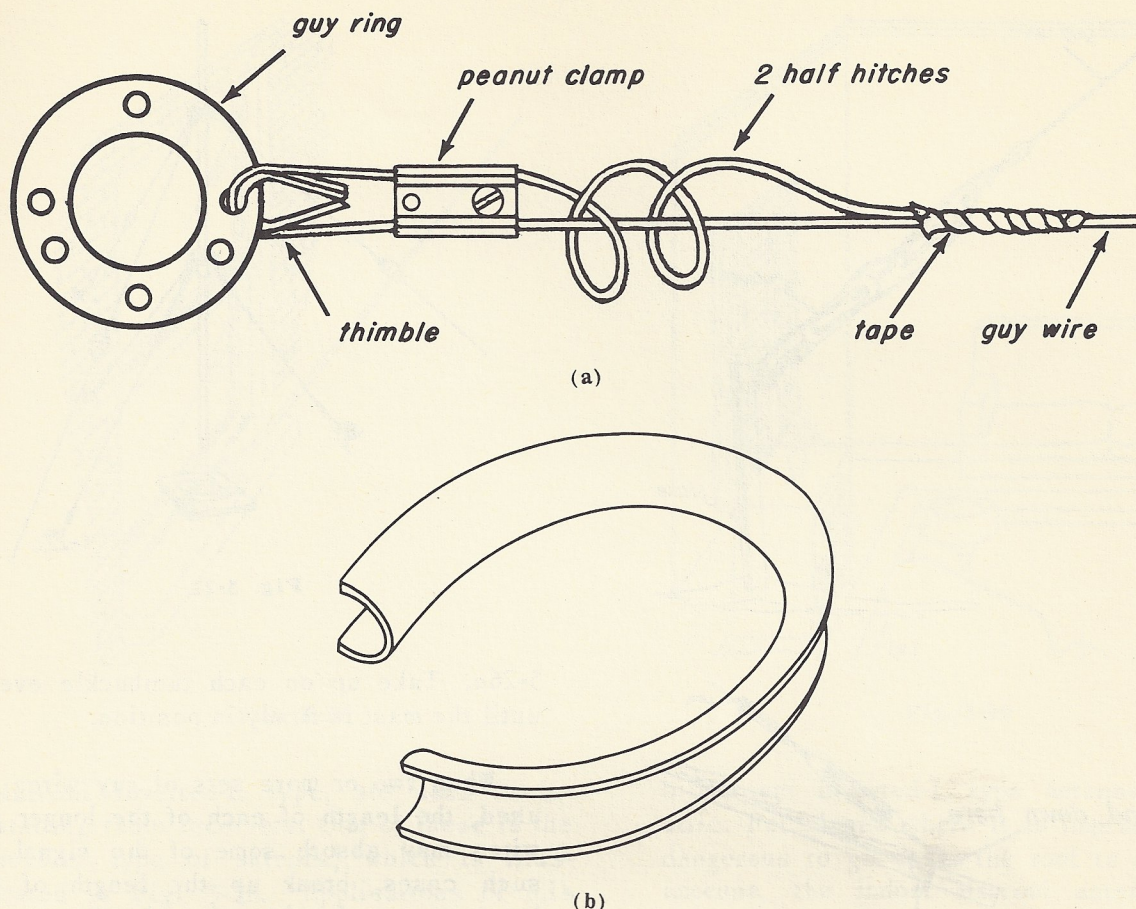


Fig. 5-24

is used for each guy to prevent too sharp a bend in the wire. A cable or *peanut* clamp is used to fasten the wires together and to prevent slipping.

A general rule of guying is: *The higher the guy wire is placed on the mast, the less is the tension on the mast and the greater is the pressure that it can withstand.* If the guy wire is placed too near the top, however, the mast is apt to buckle in the middle. A single set of guy wires is usually placed about two-thirds of the way up from the base, as shown in Fig. 5-25a. Masts more than 18 feet tall should have two sets of guys, as shown in Fig. 5-25b. Masts of more than 35 feet should have three sets of guys. However, very tall masts are not very practical because they may require special supporting towers.

Guy wires are attached to the mast before it is erected. A turnbuckle is attached to the free end of each guy wire, with the

turnbuckles in the open position, as shown in Fig. 5-26a. A roof hook anchors each of the guys, as shown in Fig. 5-26b. If anchored to the ground, the turnbuckles are fastened to stakes driven as shown in Fig.

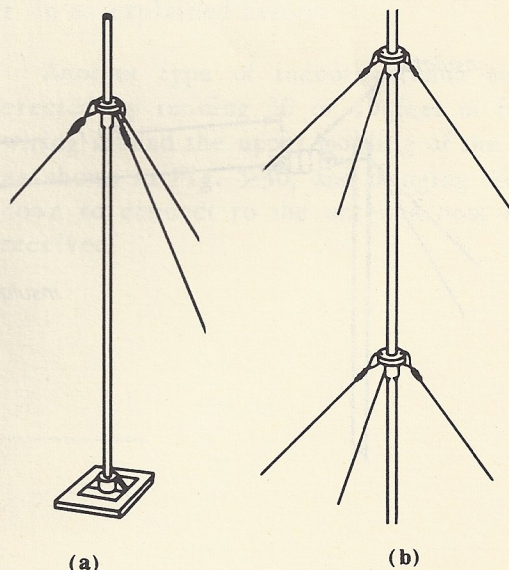


Fig. 5-25

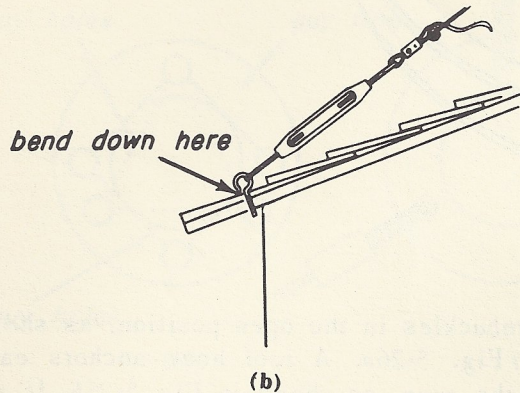
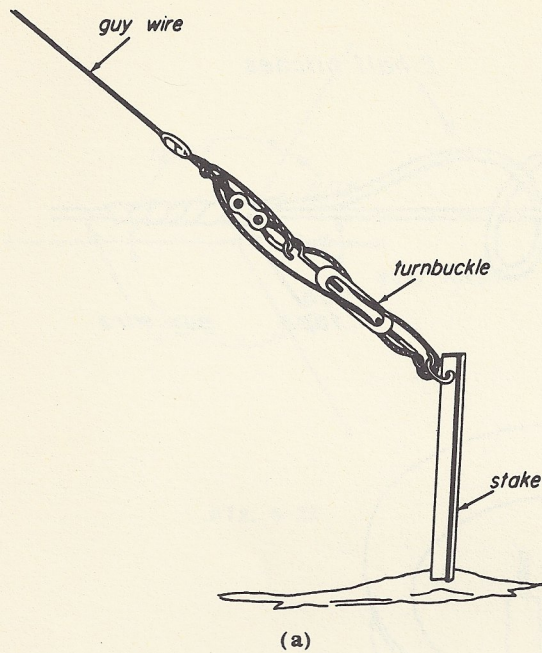


Fig. 5-26

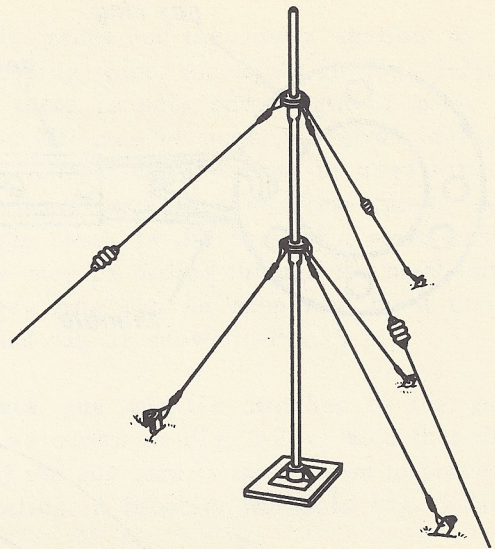


Fig. 5-27

5-26a. Take up on each turnbuckle evenly until the mast is firmly in position.

When two or more sets of guy wires are used, the length of each of the longer guy wires may absorb some of the signal. In such cases, break up the length of the longer guys by inserting insulators, as shown in Fig. 5-27.

5-10. SPECIAL ANTENNAS

Several types of antennas, other than the

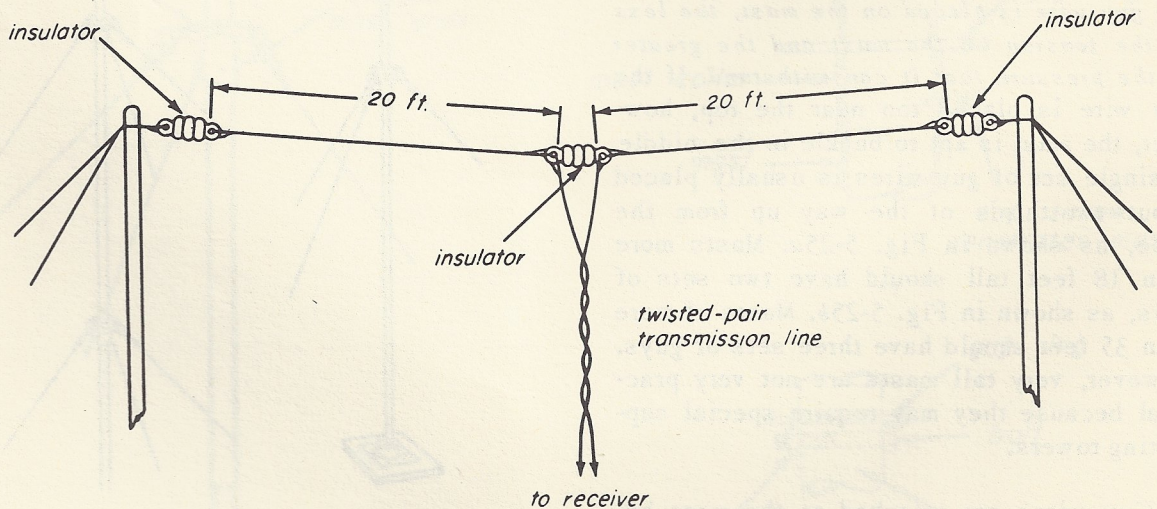


Fig. 5-28

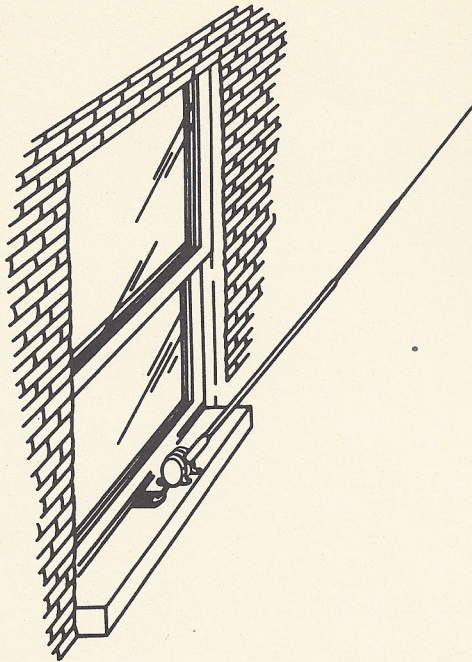


Fig. 5-29

Marconi inverted-L type, are used in installing radio receivers. One of these is the *doublet* type of antenna, which is illustrated in Fig. 5-28. Applications of this type of antenna are discussed completely in a later Service Practices booklet on noise reduction. Doublet antennas usually come in kit form with complete instructions for their installation. Figure 5-29 shows a *whip-type* antenna, similar to those used in automobile radios, but designed for mounting to the window casement in cases where other outdoor antennas are either not practical or not permitted.

5-11. INDOOR ANTENNAS

In private homes, it is possible to erect

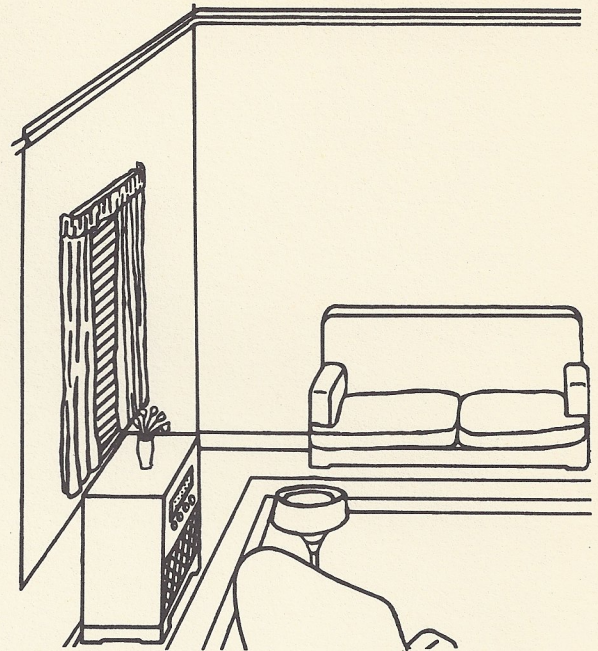


Fig. 5-30

a Marconi inverted-L type antenna in the attic. For places where it is impractical or dangerous to go up to the roof to erect an antenna, the indoor Marconi antenna may give satisfactory service. In some cases, it is possible to carry the lead-in wire between the inner and outer walls of the house. If this is not possible, it may be necessary to bring the antenna lead-in from the attic down the side of the house to the window closest to the radio receiver and to lead it in as explained before.

Another type of indoor antenna may be erected by running 30 or 40 feet of fixture wiring around the upper molding of the room, as shown in Fig. 5-30, and bringing one end down to connect to the antenna post of the receiver.